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ROTUNDA the bulletin of The Royal Ontario Museum

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Contents

The Crown Jewels of Iran
V. B. Meen, A. D. Tushingham, page 2

Spotlight *Current and future activities*, page 12

Palaeontology: From Horse Hobbles to Bulldozers
A. Gordon Edmund, page 14

The Growing Collections, page 21

Temples and Tombs in British Honduras
David M. Pendergast, page 24

Recent Publications, page 32

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The Cover:

From the Crown Jewels of Iran, the rhinoceros-hide shield of Nadir Shah, 45.3 cm. in diameter. The central octagonal ruby-red spinel, its calculated weight 225 carats, is encircled by spinels, diamonds and emeralds. Eight magnificent emeralds are each surrounded by purplish-red rubies and by 16 Indian-cut diamonds; 12 rose-cut diamonds surround each of four smaller emeralds. The shield edge bears diamonds, emeralds and rose-cut rubies, bordered by a ring of spinels.

Photograph: Leighton Warren

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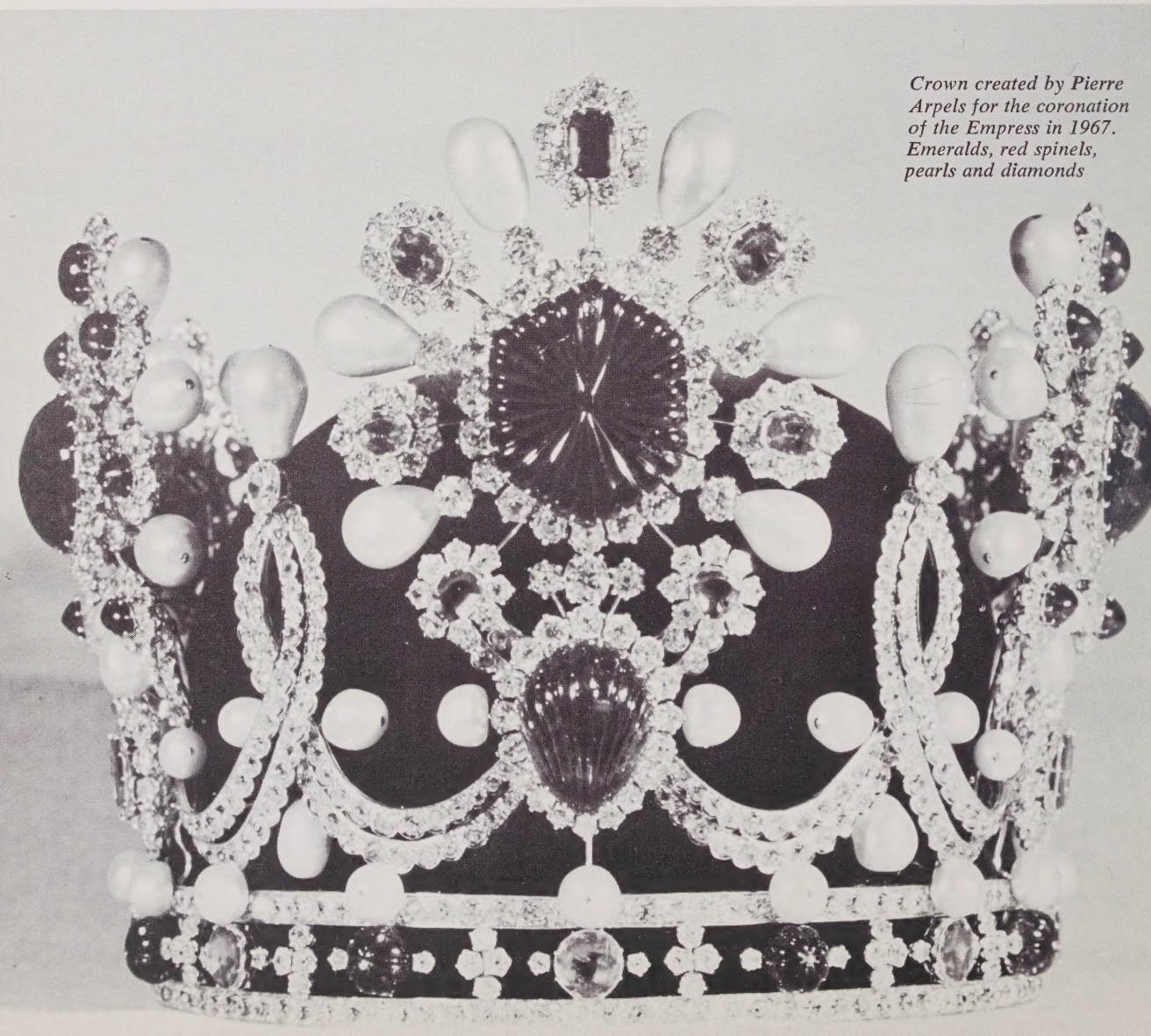
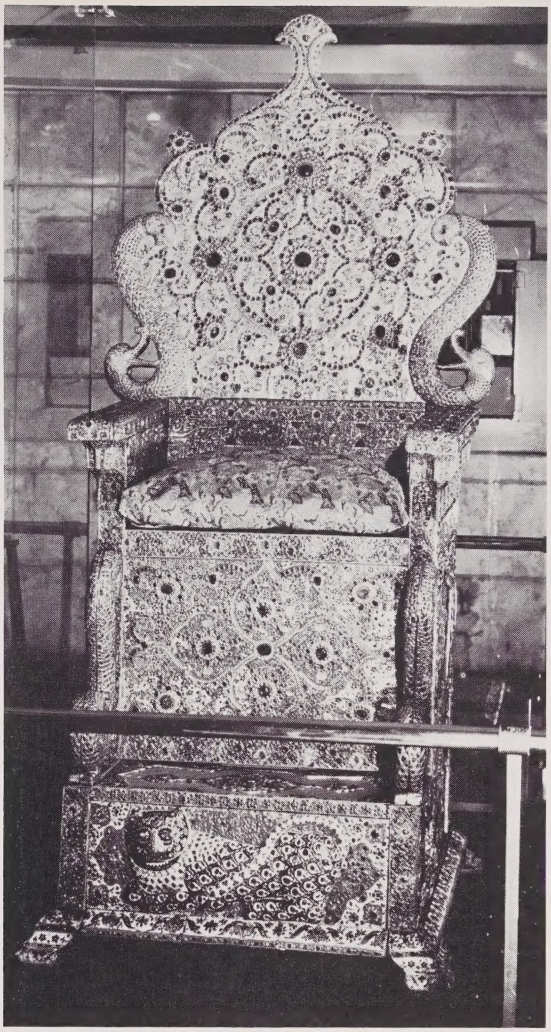
THE CROWN JEWELS OF IRAN

V. B. Meen, Chief Mineralogist / A. D. Tushingham, Chief Archaeologist



Crown created by Pierre Arpels for the coronation of the Empress in 1967. Emeralds, red spinels, pearls and diamonds



The Nadir Throne, encrusted with great gems against brilliant enamels on gold. The footrest bears a representation of a lion

On the 20th of March, 1739, Nadir Shah of Persia entered Delhi as a conqueror. When he left, less than two months later, thousands of his baggage animals carried the treasure accumulated over centuries by the great Indian emperors.

The Peacock Throne of Shah Jahan, the *Kuh-i Nur* (Mountain of Light) diamond—now in the British Crown Jewels, and the *Darya-i Nur* (Sea of Light) diamond were only the most spectacular pieces. A contemporary reports that all objects of gold and silver, other than coins, were melted down and made into ingots. Two of these, pierced with holes and secured with cords, made one camel load. Of minted coins there were five thousand chests of gold rupees and eight thousand of silver. The coffers filled with diamonds, pearls and other gems were beyond estimation.

Two hundred and twenty-seven years later, almost to the day, many of these gems were in the hands of a research team from the Royal

Ontario Museum—not as loot this time, but for scientific study.

What remains of Nadir's treasure, together with what survives of earlier Persian Crown Jewels, constitutes the bulk of the greatest collection of gems and jewellery anywhere in the world. It now rests in the vaults of the Central Bank of Iran in the capital city, Tehran, where it may be seen by any visitor. The word "vaults" conjures up a picture of tight security measures and massive steel doors with time locks, burglar alarms and armed guards. But these vaults are more than that. The walls of the security room, 110 feet long by 50 feet wide, are lined with cases, and there are also free-standing cases in which the objects are displayed, illumined by concealed lighting. One is apt to forget that this is a vault, and not just another handsome museum gallery. Then some slight jarring of a case sets off the hooter, steel doors automatically close, and the guards become obvious.

The collection today is but a residue of former splendour. Of the Indian Peacock Throne and the other thrones which Nadir carried off, only one remains: a great dais-throne presented by Nadir to the Sultan of Turkey and now on display in the Topkapi Sarai Museum in Istanbul. Many of the jewels and bullion were distributed by Nadir as gifts. He sent a large selection of his booty with an embassy to Catherine II of Russia, and several pieces can be seen in the Oriental Treasury of the State Hermitage Museum in Leningrad. More was lost in the civil war in Iran which followed Nadir's death in 1747. Nadir's grandson, Shahrukh, who reigned but hardly ruled from Meshed, held some of the treasure. The Peacock Throne and others were broken up and divided. The *Kuh-i Nur* diamond came into the hands of Ahmad Shah Abdali, one of Nadir's generals, and eventually wound up in the possession of the British East India Company which presented it to Queen Victoria in 1850. Two other great diamonds, the *Darya-i Nur* and the *Taj-i Mah* (Crown of the Moon), with other treasures were held by the Zand family which for a time ruled Iran from Shiraz. But these were nearly lost to the country. The last of the Zand line, Lutf-Ali Khan, tried to negotiate a sale with an Englishman, Harford Jones, to raise funds to carry on his war against the Qajars, but no deal was made. In 1796 the Qajars finally triumphed and reunited—by conquest and torture—the Crown Jewels which had been in the hands of Lutf-Ali and Shahrukh. With few losses, they have remained the Iranian state treasure since that time.

The ROM team soon discovered that the collection has not been without adventures even during the last 150 years. Fath-Ali Shah (1797–1834) had many of the stones mounted in new jewellery for his own adornment, commissioned gorgeous enamels on gold, and built the two great thrones which now go by the names of the "Nadir Throne" and the "Peacock Throne." But there continued to be losses to the Persian crown. After the murder of the Russian Ambassador in Tehran in 1828, Fath-Ali Shah placated the Tsar by sending the great "Shah" diamond to Russia, and in the same year, war indemnities to the same country required the use of the horde of minted gold Indian rupees which still survived from Nadir's spoils.

Changes in royal fashion led Nasir ud-Din Shah (1848–1896) to establish a museum in the Golestan Palace to display the remaining treasures, and also to augment them by purchasing spectacular diamonds from the newly discovered South African mines. When Muhammed Ali Shah (1907–09) fled to the Russian Summer Embassy outside Tehran to escape the wrath of his rebellious subjects, he carried with him some of the Crown Jewels —claiming them as his personal property. Fortunately, most were regained for the state when he was forced to abdicate.

Under the founder of the present dynasty, Reza Shah the Great, the Crown Jewels became legally and officially a possession of the State and partial backing for the Iranian currency. Since then, too, new jewellery has been made, often by well-known jewellers such as Winston and Arpels, for great state occasions, royal weddings, and coronations, culminating in the creation of many fine pieces for the coronation of Muhammad Reza Shah in October 1967. In each case, major gems taken from the state collections have been provided with new settings of platinum and smaller stones cut in modern fashion.

In the spring of 1964, one of the authors learned

Nasir ud-Din Shah (1848–96) enthroned. The central portion of a great mural depicting the Persian court, painted by Sani al-Mulk and dated 1273 (A.D. 1856). The Shah kneels on the Persian Peacock Throne and leans against pearl-embroidered bolsters. Except for the ropes of pearls, most of his regalia is in diamonds. The mural is now in the Archaeological Museum, Tehran

Dr. A. D. Tushingham tape-records a description of the imperial crown

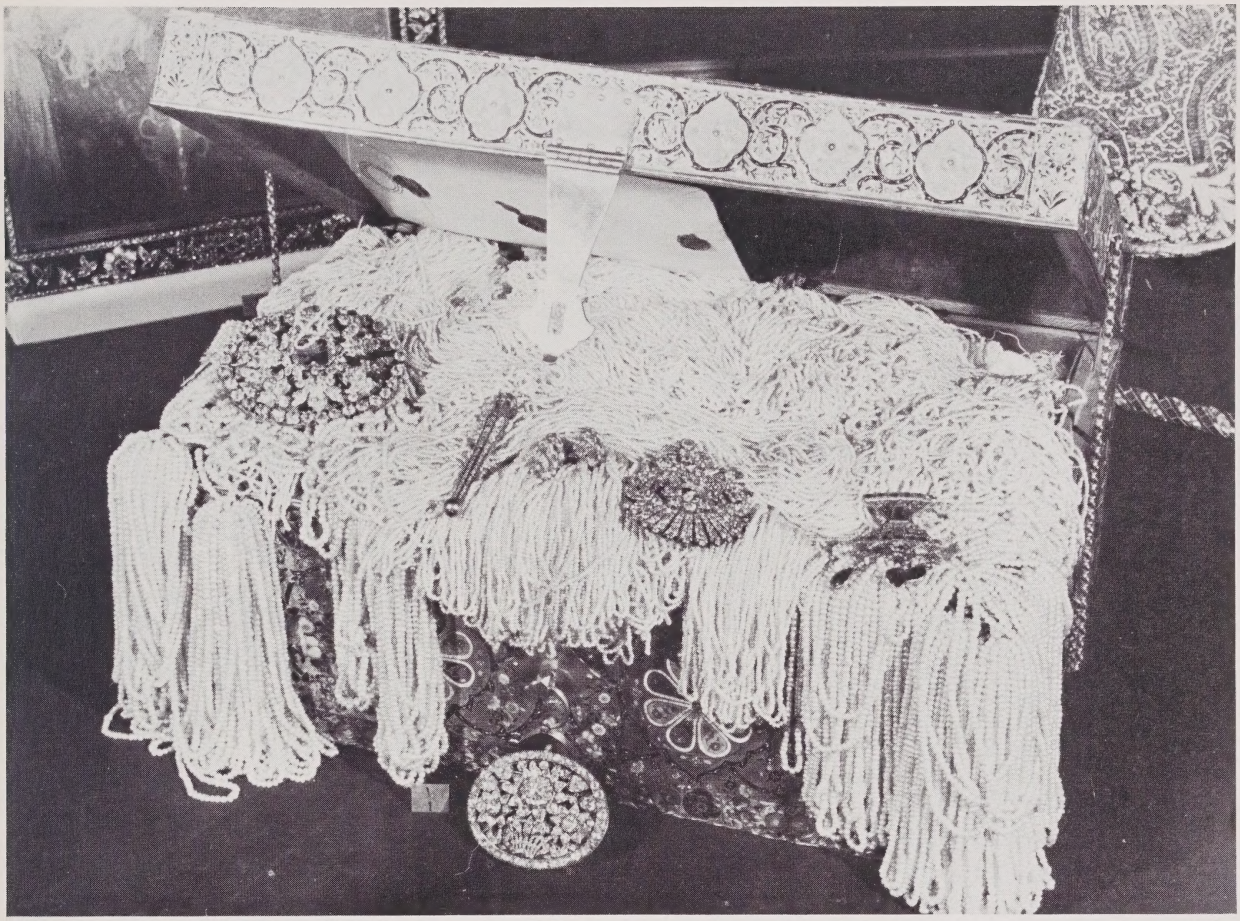
that the Iranian Crown Jewels were on public display and surpassed anything known. Gemmologists knew nothing about the collection. It was probably not published; possibly not even a catalogue existed. Could the ROM study the collection, provide a catalogue, and make the collection known to the world?

Through the good offices of the Canadian Embassy in Tehran, consultations were arranged in early 1965 with officials of the Central Bank of Iran, the custodians of the collection. Talks revealed that very little information was available concerning the collection, that the Bank had long wanted a catalogue of the major items, and approved of publishing a large, well-illustrated book, such as we suggested. No one in the country was qualified to carry out the necessary research, but if foreigners were to be entrusted with the task there was a serious problem of security. No display case could be opened except in the presence of a majority of the members of the Supervisory Board, and, because it is composed of high-ranking officials in government and business circles, their time was valuable. As it turned out they were anxious to have the work done and were prepared to allow security problems to be solved as and when they arose. A formal ROM proposal was finally forwarded by the Governor of the Bank to the highest authority for consideration. It was accepted.

It had quickly become obvious that the study could not be confined to the gems; it must also cover the history of the collection and the provenance, date and use of the jewellery, the *objets d'art*, thrones and other individual pieces. The second author thus entered the picture with responsibility for documentation. Our wives were assigned the tasks of assistants, and Leighton Warren, ROM Chief Photographer, accepted responsibility for taking thousands of pictures required for our research, cataloguing and publication. Mr. G. G. Waite, Research Assistant in Gemmology in the Museum, assisted in designing suitable optical equipment and became a member of the party.

The considerable problem of financial support was solved by the Birks Family Foundation. Their generosity provided the transportation and maintenance for a seven-man party, the necessary special equipment, and the loan of Mr. E. B. Tiffany, Chief Gemmologist of Henry Birks and Sons, for the last month of our study.

The group arrived in Tehran on February 1, 1966. We were ensconced in a large house with a staff of two, and set to work. The first two months were devoted to studying the collection through the glass of the display cases. We could make a preliminary selection of the pieces which warranted intensive study, we could make stylistic studies of the jewellery, take measurements (using a handy instrument called the Zeiss monocular fitted with a calibrated grid), and identify gems. On the four days of the week when the collection was open to the public, our studies were somewhat hampered by visitors, for we could not set up camera tripods or stretch electric cables across the floor to provide



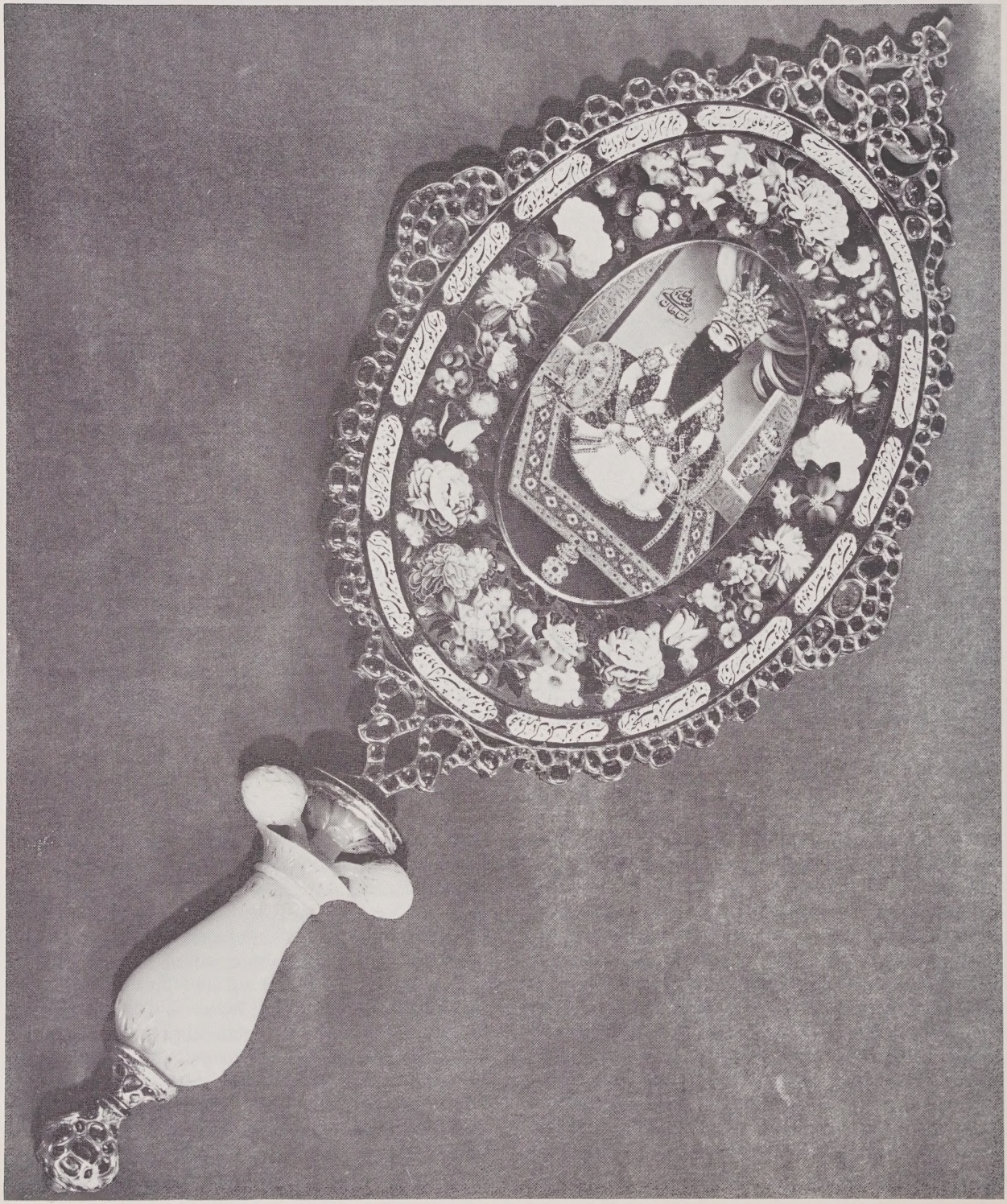
Ropes of pearls and diamond-studded ornaments spill from an enamelled chest

additional lighting. On other days, we had more freedom and accomplished a great deal.

Though our sessions in the vaults were confined to three hours, our full work day often stretched to 14 or 15. Notes, made on cards or tape recorders, had to be typewritten on file cards; the raw data had to be transformed into precise measurements and firm identification. Documentation required hours of reading in Tehran's libraries and visiting private and public collections elsewhere in Tehran. Leigh Warren had to provide record shots of the objects, and travel to government buildings, palaces and private homes to photograph portraits of former shahs (often wearing the jewellery we were studying).

Then came intensive study of selected gems and pieces of jewellery, which required handling the objects. By this time, the Board of Supervisors had full confidence in our scientific approach and satisfaction with our results. For this part of our study, since no objects could be removed from the vault, each day we had to set up and dismantle all our equipment. For each four hours of study, we transformed the hall into a gem-laboratory, a photographic studio for Leigh Warren, and a study room in which the historians could examine the construction—and particularly the reverses—of jewellery, read the minuscule inscriptions on stones and enamels, and watch for makers' marks.

When all equipment was ready, members of the



Supervisory Board would enter, examine the seals on the case chosen for study (for only one could be opened at a time), sign a register, and give the word to open up. Sometimes this took a full half hour. At first, the situation was a little tense—none of us, scientists or Board members, quite knew what to expect—and each group was very careful not to upset the other. But by the end of the second session, everyone was more relaxed. The Board became convinced that we were no new version of the "Topkapi gang" but were interested only in obtaining as much information as possible in the least amount of time. Many of them became unofficial members of our team by offering bits of information or translations of obscure or difficult inscriptions. When it became evident that we could not complete the study, even of the highlights of the collection, in the number of periods they had promised us, the Board doubled the allotted time.

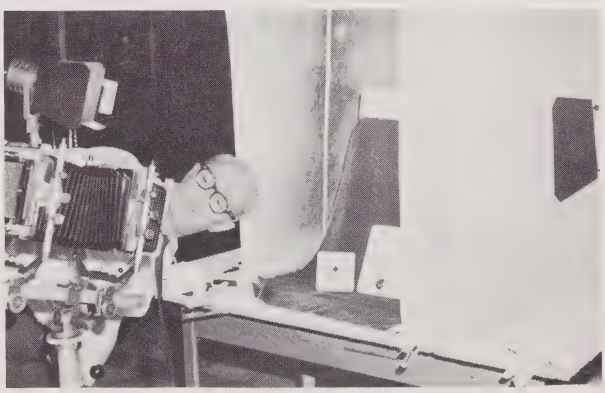
At the end of April, we called it quits. We now had an overall picture of the collection, and specific descriptions of the major items. We had ample photographic records to augment our data and to illustrate a major publication. We packed our gear and came home.

The past two years have been filled with further research. One of the authors has visited and studied many other collections, including those in the Hermitage in Leningrad and the Treasuries of several of the great shrines of Iran. Books have been consulted in the Library of Congress and the British Museum Library. The gemmologists have compared the Iranian stones with those in other great collections for weight, colour, and cut. At the same time, we have been collating all our information for the records of the Central Bank of Iran. A number of articles have been published and scientific papers delivered; others await preparation. The major work, *The Crown Jewels of Iran*, which it was hoped would coincide with celebrations of the 2,500th anniversary of the monarchy in Iran, was published this autumn by the University of Toronto Press.

Our research was both gemmological and historical. It was not, was never intended to be, and could not be an evaluation of the collection. That was

Peering through a Zeiss monocular, Dr. V. B. Meen measures jewel dimensions through the glass barrier of a display case

In the vaults, Leigh Warren checks lens aperture and shutter speed for a record shot of some of the jewellery



Enamelled hand-mirror, encircled with rubies and emeralds, and bearing the portrait of Fath-Ali Shah

The Empress Farah wearing the emerald and diamond tiara created by Harry Winston of New York for her marriage to the Shah in 1958. Necklace and brooch are of the same gems

beyond its scope and, in fact, is beyond any possibility of intelligent reckoning. But in many ways our research has been as full of surprises, of fascinating discoveries and of sheer human interest as the history of the Crown Jewels themselves.

The gems and jewellery combine historical interest and great beauty. The shield of Nadir, the great conqueror, is made of rhinoceros hide

adorned with huge and priceless gems (see Cover). It reminds us of the bloodshed connected with the treasure. Today, the *Darya-i Nur* and the *Taj-i Mah* diamonds—the former the sixth largest (and the largest pink) diamond in the world—lie at peace in the vaults for all to see. These and other diamonds, some purchased by Nasir ud-Din Shah, constitute seven of the 14 diamonds in the world weighing over 100 carats. Here are seven emeralds over 250 carats, five of them over 300 carats; here are the world's largest and fourth largest ruby red spinels; here are ropes of magnificent pearls, scores of them an inch long; here are rubies matchless in size and quality. Here, too, are enamels on gold in magnificent colours, and all the paraphernalia of the royal court—from saddle horns to food dishes, from candelabra to pill boxes, from thrones to water-pipes—each piece revealing the social life of Persia, its love for opulence and beauty, and its pride in a noble past. The treasure was not a static repository of wealth; it was used to adorn the person of the great Shahanshah and provide a fitting setting for a sovereignty which can be traced back some 2,500 years.

Dr. Victor B. Meen, Chief Mineralogist at the ROM, is a Torontonian and a graduate of the University of Toronto. For many years he held dual appointments at the ROM and in the Department of Geological Sciences at U of T. His interest in meteorites and meteor craters led in the early '50s to four expeditions to the Canadian Arctic to study the Chubb and Merewether Craters. He has travelled in most of the countries of Europe, including Russia and a number of its satellites, examining mineralogical collections and arranging exchanges with museums and universities. In recent years his studies have taken him to the Orient, examining the principal occurrences of rubies, sapphires, and jade, and to Iran to study the Crown Jewels.

Dr. A. Douglas Tushingham is Chief Archaeologist at the ROM, in charge of all ROM archaeological programmes, and a professor in the Department of Near Eastern Studies, University of Toronto. He is a graduate of Toronto and Chicago, and before coming to the ROM in 1955 lectured at Pine Hill Divinity Hall, Halifax, the University of Chicago, the American School of Oriental Research, Jerusalem, and Queen's University, Kingston. Expeditions and field work in Old Testament Jericho, New Testament Jericho, Dhiban, the Dead Sea Scroll Caves and Jerusalem indicate his interest in Palestinian archaeology. He has travelled in Europe, including the U.S.S.R., Central Asia and the Near East. Dr. Tushingham is a Fellow of the Society of Antiquaries of London.

Spotlight

Prized Possessions from Private Homes, on display until December 8, provides an opportunity to examine the preparation involved in a major exhibition.

The original idea for the show was suggested by Peter Swann, Director of the ROM. Eighteen months ago Heri Hickl-Szabo, Associate Curator-in-Charge of the European Department, and Jean Ferguson, Assistant Curator, began the planning. At that time no one realized this would be the largest temporary exhibition organized entirely by the ROM, occupying both Exhibition Hall and the Armour Court, a total of 13,180 square feet.

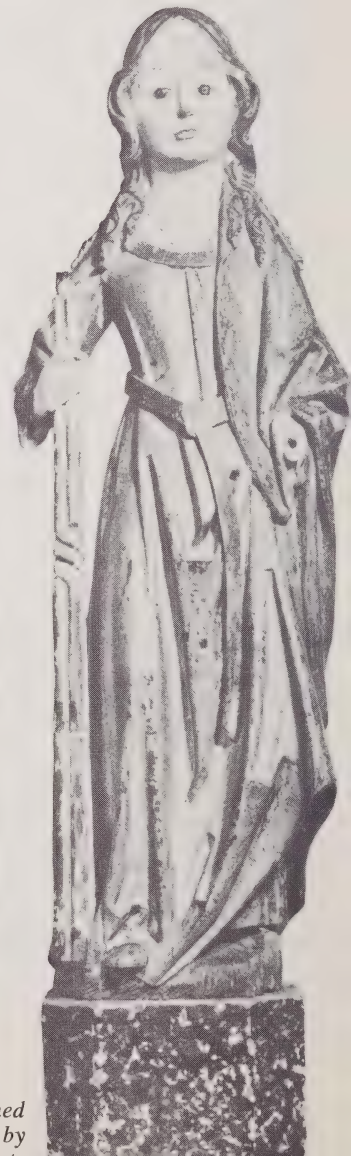
Their first task was to reach private collectors who might be willing to lend objects. Fortunately they were acquainted with many important private collections. Owners of these collections frequently suggested other collectors who might be approached. The list grew, eventually reaching almost 100.

In response to letters, 93 collectors agreed in principle to make available their treasured objects. Then the real work began. Mr. Hickl-Szabo and Miss Ferguson visited each home to select the material suitable for the exhibition. From time to time they were joined by other Museum curators who examined objects in which they were specialists. Finally, from more than 3,000 items, the selection was narrowed to 1,217.

Then Leighton Warren, the Museum's Chief Photographer, and Brian O'Donovan, his assistant, went to the home of each collector. They took a total of more than 450 photographs of which 250

Weapons section of exhibition includes rare 18th century all-metal Scottish pistols from an anonymous collector

Swiss gold-cased automaton watch, circa 1790, lent by Dr. Morton Shulman



15th century Flemish polychromed wood carving of St. Ursula, lent by

were chosen for the comprehensive exhibition catalogue. A catalogue description for each item was prepared by the European Department and the introduction to each section was written by a collector in that field. In July, the completed manuscript and the photographs were turned over to Information Services for editing and publishing.

Meanwhile, John Anthony, the Museum's Chief of Display, was busy designing the physical layout of the show, a job made more difficult because he had only monochrome photographs of the objects for reference. When his blueprints were completed, the ROM carpenters, under Don Sinclair, moved in to transform the Armour Court and Exhibition Hall.

At the same time Ivan Lindsay and his staff of Preparators began picking up the precious objects from collectors' homes. As each item arrived at the Museum, it was processed by the Registration Department and a condition report on it was prepared by the Conservation Department. Then the objects, many of them extremely fragile, had to be temporarily stored until they were placed in the display and labelled to correspond with the catalogue.

Once the exhibition opened the staff could briefly turn to other projects, except for the security men assigned to the multi-million-dollar show.

For visitors the exhibition offers a chance to see an enormous range of beautiful, often rare, and sometimes irreplaceable objects, all more than 100 years old, from many parts of the world. It contains porcelain (the largest single category) and other ceramics, glass, pewter, silver, textiles and costumes, weapons, furniture, sculpture, paintings and drawings. In scope and quality, this temporary exhibition exceeds the permanent collections of many museums.

Once the two-month exhibition ends in December, work for many Museum staff begins again. Each item must receive another condition report, be checked out through Registration and returned to its owner. The displays must be dismantled and the Armour Court restored to its normal appearance. Meanwhile preparations are underway for future exhibitions.

Terence Shortt and Paul Geraghty returned from their three-month field trip to Africa (*Rotunda* Spring 1968) with 13 car crates of material. Much of it was intended for two African dioramas Mr. Shortt, Chief of Display Biology, and his assistant, Mr. Geraghty, will construct. But they also brought back specimens for other departments, including birds for Ornithology, large, colourful hawk moths for Entomology, and bats and other mammals for Mammalogy.

Dr. R. L. Peterson, Curator of Mammalogy, was particularly enthusiastic about their gift of 322 bats from Uganda. He said one apparently represented a striking species completely new to science. There also were ten species of the family *Molossidae*, several of them extremely rare. In recent years, Dr. Peterson has assembled one of the world's largest research collections of bats, totalling more than 8,000 specimens. He has published several scientific papers in the field, including the recent *A New Bat of the Genus Vampyressa from Guyana, South America* (ROM Life Sciences Contribution 73).

Former ROM Director Theodore Heinrich lent The Judgment of Paris, *a pen and bistre wash drawing done in 1592 by Abraham Bloemaert*

Furniture includes English walnut settee, circa 1710, with contemporary embroidered upholstery

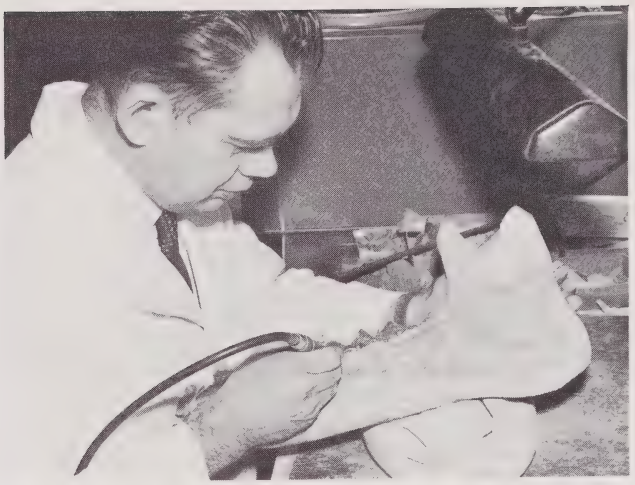
Silver teakettle, stand and lamp were produced

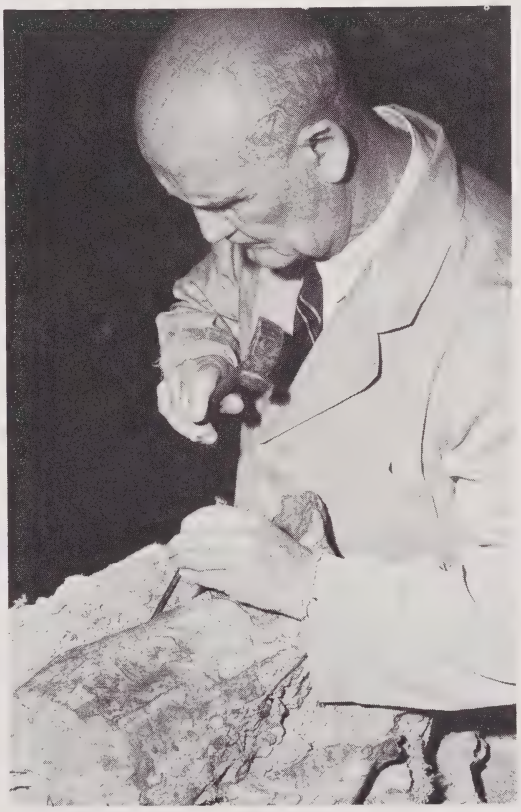
PALAEONTOLOGY:

from horse hobbles to bulldozers

by Dr. A. G. Edmund,

Curator of
Vertebrate Palaeontology





Dr. Edmund cleans a Brontothere jaw with the high-speed pneumatic chisel

Ralph Hornell using hammer and chisel to extract Brontothere skull from rock excavated in the Cypress Hills, Saskatchewan

The old grey mare waits to be hitched to the wagon—1916 National Museum of Canada photograph

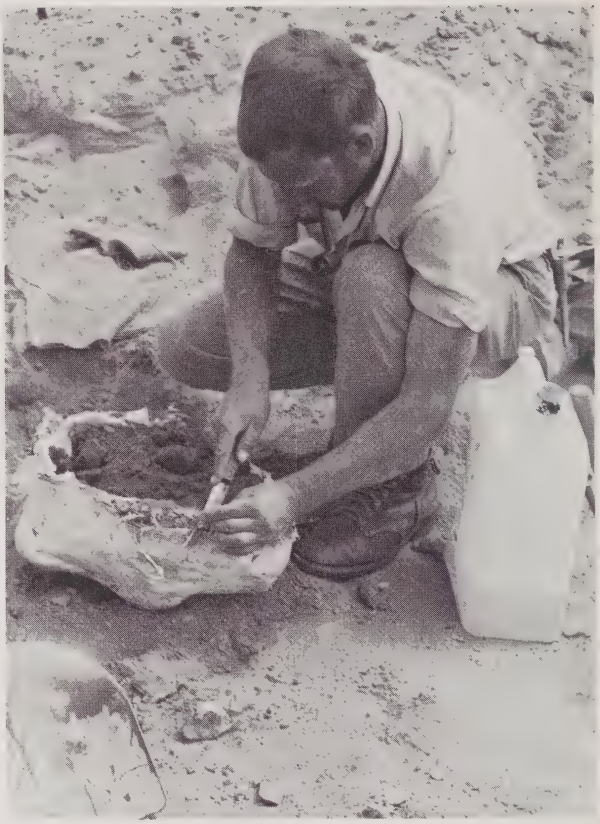
On the wall of the Vertebrate Palaeontology laboratory at the Royal Ontario Museum hangs a pair of horse hobbles. They are mute reminders of the days when horses were the only motive power available for work in the field. Supplies were carted in by horse; the collector rode on horseback and specimens were taken to the nearest railroad by horse-drawn stoneboat and wagon.

Now, the collector seeking fossils has at his disposal bulldozers, power drills and a variety of other modern equipment. Probably the only part of palaeontological field work that hasn't changed is deciding where to dig. The collector still must locate rock formations of the right type and age, then walk over the area examining it carefully. Days may go by without significant discovery. But eventually pieces of bone may be found in their natural position in the rock.

Then the real work begins. In the past this could mean weeks of labour with pick and shovel or hammer and chisel. But for the modern collector a wide choice of excavating techniques is available.

As an example, let me describe some work done by one ROM field party. This museum has spent several field seasons in the vicinity of Eastend, Sask., where rocks of Oligocene age,

about 40,000,000 years old, have been known to contain fossil bones. Early in June, 1967, a rocky layer showing fragments of skulls, jaws and other bones was found on a hillside. Obviously the bone layer extended a considerable distance into the hill, so it was decided to open a quarry to explore its extent. A bulldozer was hired, and in less than a day we had our quarry. The machine removed the sand and loose rock to within a foot of the bone layer, leaving a minimum of hand work. Quickly we located several skulls and jaws, all firmly embedded in concrete-like rock. Removal by the old technique of hammer and chisel would mean weeks of work, and the pounding would imperil the fragile bones. Instead, a special rock saw was used to slice around the fossil, leaving it surrounded by a square block of rock for protection. A gas-powered jack-hammer quickly ripped away the rock on the outer side of the saw cut, so that the block could be plastered. Further work with the jack-hammer permitted the block to be rolled over. The saw then cut off the excess rock on the underside and the specimen was ready for removal. Some of the blocks were too large to be lifted by



The bone-bearing block is wrapped in plaster-soaked burlap

Using a hammer and chisel to extract a fossil—still an important technique

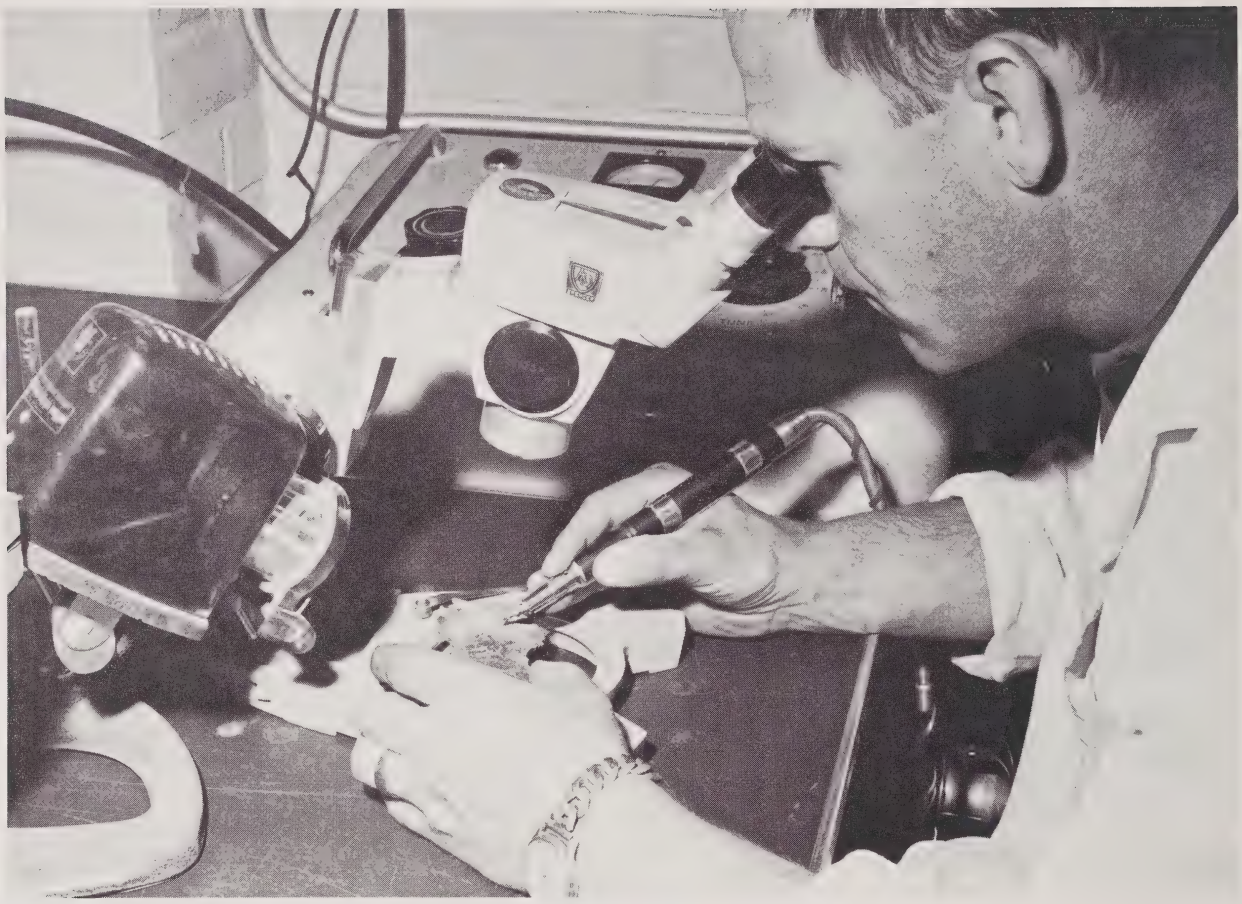
hand, so we rolled them onto a stoneboat and used the power winch on the Land Rover to pull them out of the quarry and down to the nearest road.

The entire quarry floor was soon cleared of bones and still the layer continued into the hillside. Because of the steepness of the hill, the bulldozer couldn't climb the quarry to enlarge it. The obvious solution was to use dynamite. In the past, when dynamite or perhaps black powder had to be used, the shot-holes were drilled with a hand auger, a back-breaking procedure. With the gasoline-powered rock drill, however, we quickly drilled a series of holes about ten feet back from the edge of the face and detonated about one hundred sticks of dynamite. Then the 'dozer cleared the face of the quarry back by about 20 feet over a hundred-foot front. The same process was repeated three times during the summer, with fresh bone appearing each time we extended the quarry. Seventeen crates of fossils were collected in 1967. We returned in the summer of 1968 and extended the quarry a further 50 feet into the hillside, recovering another four tons of bone-bearing blocks. The bone layer is now under more than 40 feet of overburden, so that further excavations will probably be prohibitively expensive.

Another very important advance in collecting technique involves screening and washing great quantities of sand or soft rock to recover teeth, jaws and bones of small animals. In the past emphasis has been on the larger, more obvious beasts. Little was known about many important groups of smaller creatures, including our own very distant ancestors. Perhaps the odd little tooth was picked up off the surface by a sharp-eyed collector, but such discoveries were rare. A few years ago, palaeontologists, eager to know all the animals represented in a particular fauna, decided to sift the sandy matrix surrounding the larger bones. They were surprised to find a significant number of small specimens whose presence was completely unexpected. Soon the technique was tried on deposits of different ages, often with exciting results.

Sometimes the little fossils can easily be screened out of dry sand. At other times the bones are in tough clay or soft rock which must be repeatedly washed, sifted and dried. Sometimes a ton of sand yields hundreds or even thousands of speci-

Red Deer River, Alberta, 1916—lowering a rock slab containing a fossil to the team waiting far below
National Museum of Canada photograph



Gordon Gyrmov using the Cavitron machine

mens, sometimes only one or two. In most cases, however, the specimens are well worth the effort, since they frequently prove to represent new and important groups of animals. The sifting and washing technique has already added several thousand specimens to the ROM collection, and a mechanized sifter was used successfully in the 1968 field season.

Advances in collecting techniques are parallelled by those in the preparation lab. In the early days, the bones were broken out of the rock in the field and then efforts were made to fit them together back in the lab. Later, field workers began using flour and water to paste strips of paper onto the surface of delicate specimens. Eventually they borrowed the technique of the surgeon and wrapped the bone-bearing blocks with strips of cloth (usually burlap) soaked in plaster. This technique still is used today and plastered blocks may range from a few pounds to half a ton or more.

Once in the lab, the packets and plaster-wrapped blocks from the field are opened and the delicate task of uncovering and strengthening the specimens begins. Each year new methods, machines and materials are investigated to see what will make the job easier, faster, safer or more permanent. Skills and materials are drawn from many fields, from dentistry to die-making, from organic chemistry to metallurgy. Some require sophisticated equipment, while others are merely logical applications of simple processes.

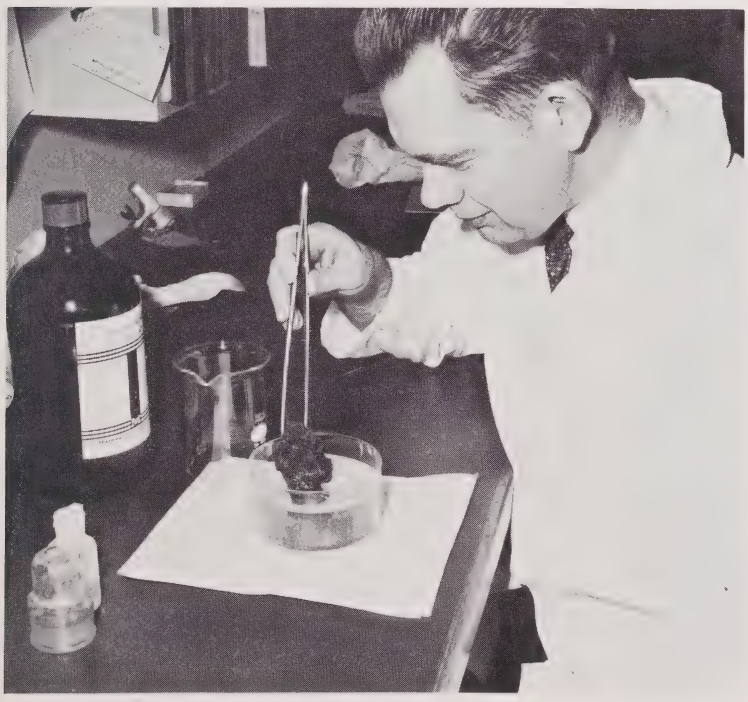
In a lab at a famous New England university, a

young graduate student, frustrated with the specimens he was studying, threw them into a dish of strong acid. The delicate bones bubbled and dissolved, and were lost forever. Tragedy? On the contrary. A new technique was born. The bones of the salamander-like creatures had been embedded in fine grained carbonaceous shale. When the shale was split to uncover the bones, the bones also split, revealing only their broken inner faces. When the bones were dissolved, however, their delicate impressions in the shale remained, natural moulds which yielded excellent rubber casts of the original surfaces. For the first time the real shapes of the bones could be determined.

Acid is used in many ways to develop delicate fossils. Frequently the bone will resist the action of weak acid, while the surrounding rock will dissolve, leaving the bone remarkably clean and undamaged. Often acid preparation is the only method of preparing certain very fragile specimens. At the British Museum, a new technique permits all of the rock to be dissolved, leaving the skeleton seemingly suspended in a block of clear plastic.

Acid preparation is only one of the techniques which has come to the aid of the palaeontologist in recent years. The old-time preparators worked primarily with hammers, chisels, and scrapers. Indeed these techniques are still used for certain kinds of specimens. However, there is great danger of shattering delicate fossils in the process of removing the rock. Such work is now usually done with a high-speed air-driven chisel not much larger than a fountain pen. Even this technique may be too coarse for some specimens, and the technician can use either the Cavitron or Airbrasive machines. The former bears a fine chisel-like tip which vibrates at 28,000 strokes per second. Tungsten carbide tips especially shaped for the purpose can carve the last scrap of matrix from delicate skulls and jaws.

Even more versatile is the Airbrasive machine. Originally designed for use by dentists, it shoots a stream of fine abrasive particles against the rock, washing it away with surprising speed. As the bone becomes exposed the operator switches to a less abrasive powder to remove the final fraction of a millimeter. The Airbrasive machine has finally mastered the worst scourge of the preparator—iron-

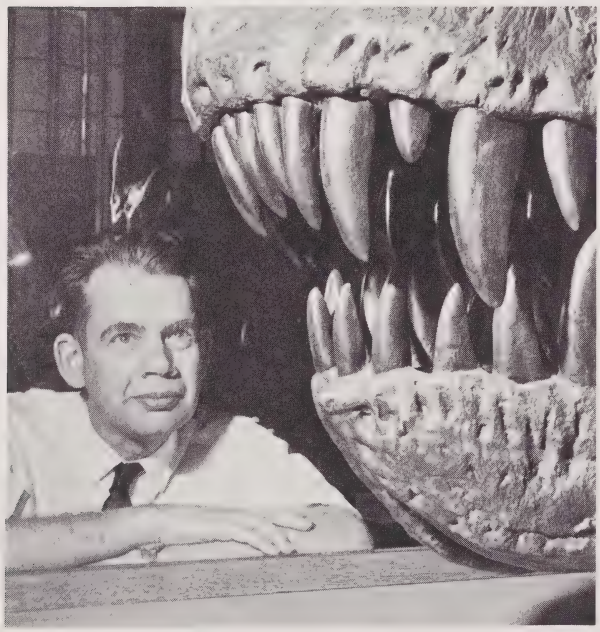


Removing a fossiliferous rock from a bath of formic acid

stone. This is an extremely hard encrustation which frequently coats otherwise valuable specimens. In the past ironstone-encased specimens were either not collected or else placed in dead storage. Today, with patient care they can be completely exposed. Surprisingly, the airbrasive is also invaluable for soft specimens. Recently it was used to prepare the skeleton of a small reptile which, at first, did not appear to be unusual. The delicate airbrasive technique soon revealed the presence of gliding membranes—now preserved as impressions in slightly harder rock, which would never have been detected by more traditional preparation methods.

Only rarely are vertebrate fossils found without thousands of fine checks and cracks. So long as the fossil is kept in the rock, the pressure of the rock holds the specimen together. Once the rock is gone, the bone crumbles. Early palaeontologists used various types of glue to strengthen fossils. Later, both the collector in the field and the preparator in the lab used shellac. Unfortunately shellac darkens with age; worst of all, it weakens and finally crumbles. Modern plastics of various kinds have solved the problem of hardening. The transparent, tough and long-lasting poly-vinyl compounds appear to be the most versatile. A solution of plastic is usually allowed to soak into the fossil. At the ROM we are experimenting with a high-vacuum chamber which can force the plastic solution into the very centre of the fossil, resulting in greatly increased strength. Other compounds, such as polyethylene glycol, are used to preserve bones, teeth and tusks which have come from wet locations. In the past these cracked and shattered when they were allowed to dry. Treatment with the appropriate chemicals renders them tough, stable and resistant to the effects of low humidity.

The work of the preparator in vertebrate palaeontology still requires infinite patience. Many of the techniques require days or weeks of careful work, but today it is possible to dispense with much of the drudgery, to produce excellent specimens from material once considered impossible, and to preserve irreplaceable specimens for future palaeontologists.



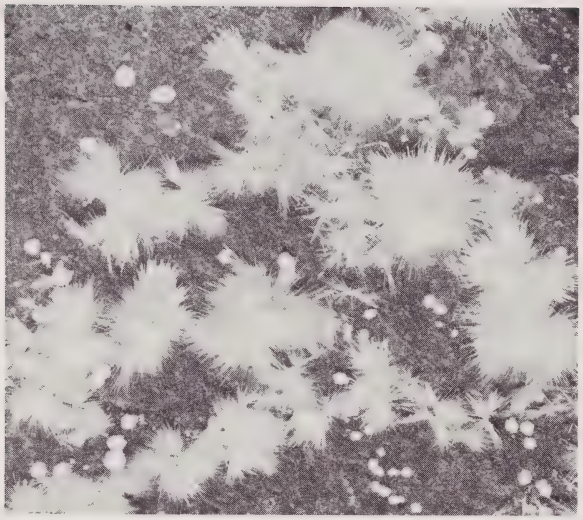
Dr. A. Gordon Edmund, Curator of Vertebrate Palaeontology at the ROM, is a graduate of the University of Toronto and of Harvard. He has studied specimens in all the South American and European countries, has done field work in Quebec, the Maritimes, Texas and the American Southwest, and has led expeditions to Peru, Ecuador, and Alberta. His special research interests include reptile teeth and South American giant ground sloths, but to most Ontario youngsters he is best known as the man in charge of the Dinosaur Gallery.

The growing collections

Through the generosity of many friends, the ancient Egyptian wall-painting announced as a loan in ROTUNDA, Winter 1968, has been purchased by the Museum for $25,000. School children enthusiastically deposited coins, Museum visitors gave bills, public-minded individuals and corporations donated cheques, and now only about $5,000 is still needed to complete payment. The painting, a fragment about 11 inches high, comes from a famous private tomb at Thebes dating from the reign of Amenophis III (1410–1372 B.C.). It shows two relatives bringing offerings of lotus-flowers and ointment to the owner of the tomb, a royal sculptor named Ipuky. It is remarkable for the freshness of its full colour and for its lively and sensitive line. Ancient Egyptian relief-sculpture, carved in stone, is particularly well represented in the ROM, but wall-paintings are seldom seen outside Egypt, on account of the fragility of the mud plaster on which they were executed. The painted tombs themselves have steadily deteriorated during the past century.

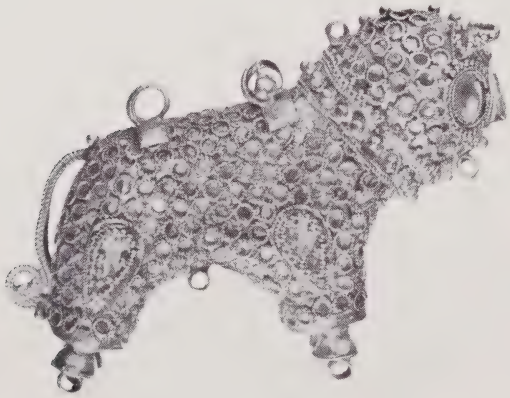
Mounted specimen of the now extinct Heath Hen (*Tympanuchus cupido cupido*), one of four shot on Martha's Vineyard Island, Massachusetts, in 1909. It was purchased recently by the Department of Ornithology from Mrs. Frank Wilbur of Chepachet, Rhode Island.

Other rare specimens accessed by Ornithology during June included the ROM's first Dwarf Vireo (*Vireo nelsoni*), a species known to science from less than 20 specimens; the first breeding specimens of the Gray Vireo (*Vireo vicinior*) from Coahuila, Mexico; and the second specimen of the White-winged Dove (*Zenaida asiatica*) from British Honduras.



Detail of the rare mineral, *Artinite*, from Staten Island, New York. Three excellent specimens were recently acquired by the Department of Mineralogy by exchange from Dr. and Mrs. L. Reasenberg. A large specimen of *Fluorite* from Saxony, of an unusual blue colour, is the generous gift of Dr. M. H. Frohberg. Other acquisitions include a superb group of orange-brown crystals of *Wulfenite* from Tsumeb, S.W. Africa, a display specimen of *Arsenopyrite* from Panasquiera, Portugal, and several specimens of minerals not previously represented in the ROM collection.

The Greek and Roman Department has acquired a fine Greek vase, a large drinking cup. It dates from the second half of the 5th century B.C., and is in the Cabiran style which humorously mimics scenes on contemporary Attic red-figure vase painting. Two nude pygmies dance gaily to the tune of the double flute, vigorously blown by a girl; on the opposite side are a trailing vine and large clusters of grapes. The drinking cup is the only example of this category of Greek vase painting in the ROM collections.



The West Asian Department has acquired a delicate gold charm only an inch in length, in the shape of a lion or leopard. Twisted bands of gold form circles which simulate spots along his body, and his legs were once encrusted with precious gems. Two large stones filled the now vacant eye-sockets. Around the neck is a collar with simulated jewels, identifying the animal as the property of the prince's royal game preserves. The charm dates from the Seljuk period in Iran (11th–12th century, A.D.).

A handsome collection of pottery from Islamic countries—49 bowls, juglets, dishes and jars, dating from about 800 A.D. to 1800 A.D. —is the gift of the late Miss Helen Norton. The new acquisitions range from small delicate bowls that fit the palm of the hand to massive storage vessels. They help to fill important gaps in the ROM's present store of Islamic pottery.

Overshot coverlets were once the pride of every farmhouse in rural Ontario. Such coverlets make up the bulk of some 50 examples, woven in the province, which have been acquired during field trips last spring, ranging some 6,000 miles from Windsor to the Ottawa River and as far north as Renfrew and the Bruce Peninsula. A selection will be on display in the Ontario Textile Gallery this autumn.

Stucco face from façade of minor temple about A.D. 800–850

temples and tombs in British Honduras

Until ROM excavations began at Altun Ha in 1964, the coastal region of British Honduras had been considered merely a cultural backwater of the tremendously rich Maya civilization. Even in our wildest expectations, we did not foresee that our work might cause a re-evaluation of the importance of peripheral Maya settlements.

Selection of Altun Ha was based largely on chance. The area was archaeologically unknown and the terrain, choked with vegetation, prevented a systematic search. However, discoveries by neighbouring villagers led us to believe that the site, 30 miles north of Belize and six miles from the shores of the Caribbean, might provide significant new data on the Maya civilization. This highly-developed ancient civilization flourished from about A.D. 250 to 950 in the regions of what are now southern Mexico, British Honduras, Guatemala and perhaps as far south as Spanish Honduras.

Altun Ha was a moderate-sized community on the eastern edge of the Maya area. Covering approximately four and one-half square miles, its population once numbered eight to ten thousand inhabitants. It was, perhaps, the political and religious capital of a small region extending 20 to 30 miles along the coast. Like most Maya centres, it consists of a series of large temples surrounded by residential complexes and small ceremonial structures. There are more than five hundred buildings, most of them low, rectangular stone residential platforms. The heart of the site is a ceremonial precinct of two large plazas bordered by five temples ranging in height from 45 to 68 feet. At one side there is a row of palaces—residences of the priest-rulers.

Unlike their land-locked agricultural neighbours, the people of Altun Ha were both farmers and seafarers. We recovered large quantities of marine shells and fish bones from kitchen refuse dumps and the fill of building walls and platforms. Special types of shells, coral and stingray spines were found in tombs and offerings. The shells are a type found only at depths ranging from 40 to 100 feet, indicating that Altun Ha had a group of diving specialists.

Evidence suggests that Altun Ha was a trading centre of considerable significance, providing ceremonially important marine materials to inland sites, perhaps in return for things such as the highly-prized green tail-feathers of the quetzal bird not found in the coastal region. Trade also stretched along the coast, extending as far south as Spanish Honduras and possibly farther into Central America, while to the north, commercial links may have reached into the modern state of Yucatan.

Commerce seems to have brought a more cosmopolitan and, in some senses, richer way of life. This aspect, combined with its distance from other lowland centres, appears to have produced a distinctive pattern in the

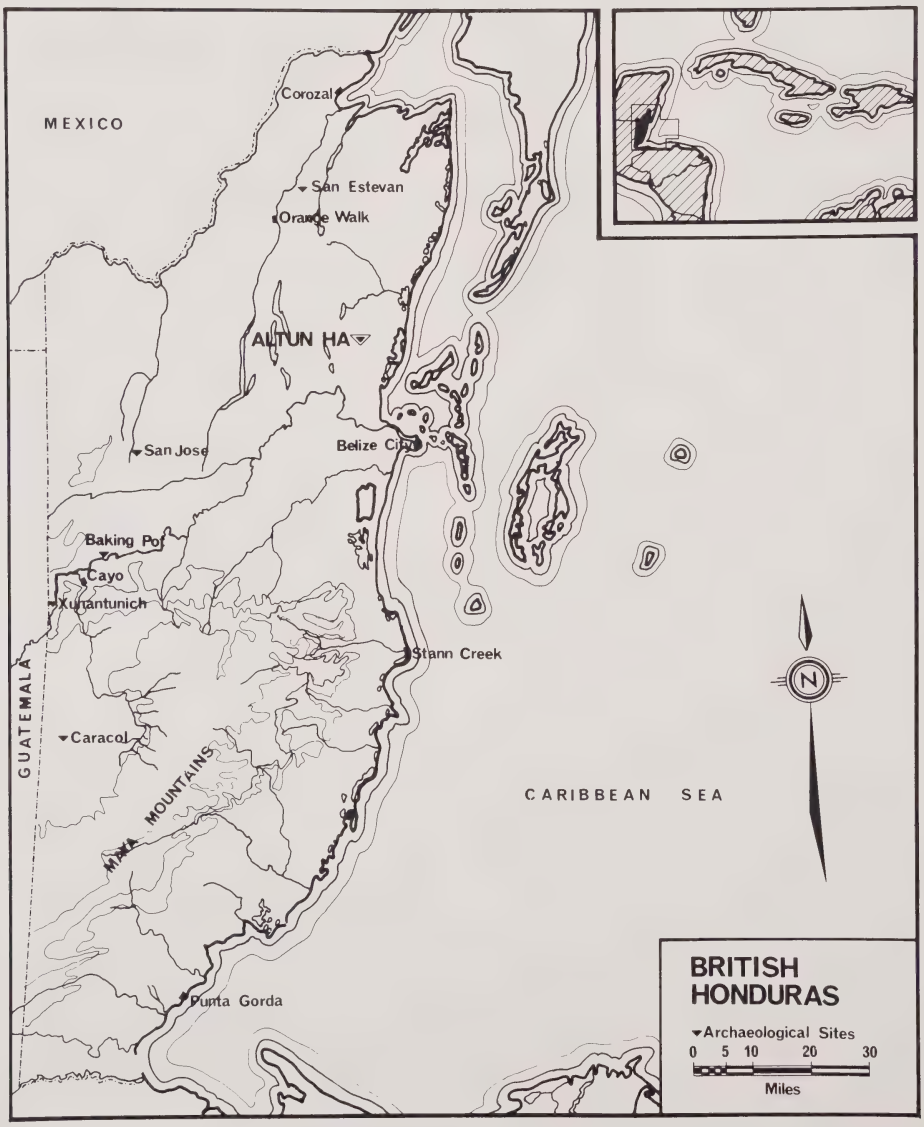
Human figurine of Serpentine from Early Class tomb about A.D. 400–450

by David M. Pendergast,

Associate Curator,
Office of the Chief Archaeologist

arts, especially in architecture. We cannot be certain if this distinctiveness extended to the highly complex religious belief and practice which were the heart of Maya society, although it is likely that a marine deity was more important at Altun Ha than at other Maya communities.

We could not hope to examine all the structures at the site nor all aspects of ancient life here. Instead, sampling as widely as possible, we have been excavating major temples, minor ceremonial structures and houses of various types and locations. From the beginning our work has been supported by the Harvie Foundation. In other seasons, we have also had assistance from the Wenner-Gren Foundation, the University of Utah and the Canada Council. When excavations are terminated in 1969, our sample will be no more than 10 per cent of the total, but it has already given us sufficient basis for reconstructing the broad fabric of prehistory at Altun Ha.



The first settlers were probably drawn to the site by the presence of a small spring-fed pond. By 200–100 B.C. or earlier, they may well have established a small complex of ceremonial structures and residences around the artificially-enlarged pond about four-tenths of a mile south of the present site centre. Some of the ancient construction has been obliterated by modern road-building. But it is possible to envision growth, including cyclic rebuilding of the principal temple near the reservoir, until about A.D. 250 when the last reconstruction of the temple occurred. The focus of life may then have shifted to the present centre farther north, although some families continued to live near the pond. The ancient temple may have remained in use for some time thereafter.

Our excavations in this temple, still in progress, show that at least one priest was interred in the fill of a reconstruction capping earlier buildings. This presaged the pattern so common later in the Classic period, between the third and 10th centuries A.D., when Maya civilization was at its height. Other areas of the site may have been settled during the early period but it is difficult to say. Except for one or two mounds, the early remains are effectively hidden from our prying by products from centuries of living and a millennium of tree growth and decay. Apparently a great spurt in cultural development came with the growth of the present site centre. By mid-fourth century A.D., there was a heavy concentration of wealth in the priestly segment of society. Tombs from this period contain carved jades, elaborately painted pottery vessels, pearls, groups of giant flints, necklaces of jade and shell beads, and a variety of other remains of priestly raiment and ceremonial objects. The tombs themselves lie in a small crudely-built mound forming part of a residential complex, probably occupied by priests and their families.

The effort of hundreds or thousands of people from the lower classes must have been directed toward raising major temples in the central precinct. In addition to the tremendous task they represent, the temples involved highly skilled architectural efforts either by the priests or by members of a group of retainers which began by this time. Construction was not carried out by men under the whip, but was considered by the masses to be a form of sacrifice, necessary for the success of agricultural life and the very existence of the community.

The priests wielded enormous power over the lower classes. They predicted celestial events by means of a highly precise calendric system based on centuries of astronomical observation; they also had intricate formulae to propitiate the gods; and they used a sophisticated hieroglyphic writing system—all beyond the ken of the masses. It is not likely that these arts were developed or invented at

Shell mosaic figure, about three inches high, was found in a small ceremonial building south of the site centre

Altun Ha, but all were in use in the early Classic period and may have been brought, at least in rudimentary form, by the first inhabitants.

In the site centre we have excavated three of the five temples and two of what may be a series of four priestly palaces. The palaces overshadow the homes of middle-class families by their size, location in the ceremonial precinct, and more permanent construction. Less is known about life in the priestly palaces than in houses of the lower classes. The commoners simply tossed their food scraps, broken dishes and utensils out the back door, leaving a treasure trove of information for archaeologists. The priests, or probably their retainers, were much tidier, and rarely left even food scraps for our edification.

Knowledge of the priests comes not so much from the remains of their lives as from the remains of their deaths. Entombed with their bodies, frequently in the reconstructions of temples where they performed ceremonies depended upon by the community, are symbols of priestly wealth. From three burials, we also recovered fragments of codices or Maya books. These were made of a type of paper coated with a thin stucco wash and usually dealt with ceremonial subjects. Time and humidity have destroyed the paper, but hundreds of fragments of the wash have been found, indicating that interring codices with priests was characteristic of the Classic period.

Perhaps the most important in terms of broad understanding of Maya civilization are three tombs which were intentionally desecrated at the collapse of Altun Ha about A.D. 925–950. The jades, other artifacts and the bones themselves had been smashed, some tomb contents burned and the lot strewn both in the chambers and over the surrounding parts of the structure. These acts of revenge were probably made by an aroused lower class who had suffered heavy strictures and physical burdens. While a violent end to Maya civilization has been suggested before, the Altun Ha data provide the first concrete evidence supporting the theory.

Excavating temples is like peeling an onion with the outer layers often rotted away. About every 52 years, a temple was rebuilt or capped, eventually producing a structure of many superimposed layers. Reconstruction was a ceremonial act which was not dictated by the state of disrepair but by a sort of life span of the building.

Not all of the temples yielded tombs. In one building, an examination of seven reconstructions produced only one tomb. In at least two other structures, several burials of priests were located in the various reconstructions.

Seven phases of one of the two largest temples have been probed and all but one contained tombs. These were usually close to the top of the structure, contrasting with the practice at other Maya centres where the temple was often erected atop a tomb.

We dubbed this structure "Temple of the Masonry Altars" because it contains a series of unique round masonry altars on top of the fifth, sixth, seventh and eighth reconstructions. Its tombs, like others at Altun Ha, are crudely built with boulder walls, an earthen floor, and a ceiling made of nine or 10 huge flint slabs, each weighing a half-ton or more.

Despite its crudity, one tomb of the "Altars" Temple contained an array of riches unequalled at many other Maya sites. It was built as part of the seventh phase and dates from A.D. 600–650. We stumbled on it by pure luck, during excavation aimed at clarifying some architectural features. Had we cut our trench one foot narrower, we would have missed the crypt entirely. Once we found the tomb, we were still faced with removing nearly nine feet of fill covering the roof slabs. Since one of the flint slabs had slipped from its footings, it was impossible to excavate the tomb without removing three of the nine massive flints. These were hoisted from the nine-foot-deep trench, but collapse of the tomb's east wall left two slabs unsupported. Two others were cracked in half under the weight of the overlying fill. Insertion of bracing eased our worries a bit, but we breathed a sigh of relief when the excavation was completed without mishap.

The collapse of the east wall covered the tomb's skeleton and artifacts with a mass of lime soil and stone blocks. After the largest blocks had been removed, we began clearing away the debris. Soon, my efforts with a brush and ice-pick in the probable area of the upper body revealed a bit of jade. At first, I assumed it was a pendant which had shifted

Kinich Ahau, the Maya Sun God. Largest jade object found in the Maya area

above the resting surface of the skeleton from the force of the wall's collapse. I cleaned further, accompanied by mounting interest and comment from the crew. Resting on the lower right arm of the priest was the largest carved jade object ever

Temple of the Masonry Altars. The Sun God's Tomb was found in the large centre stair block near the top. Altar of Phase VI is visible at the summit

Hoisting flint roof slabs

Dr. Pendergast (left) in the Sun God's Tomb

recovered in the Maya area—a spectacular full-round carving of the head of Kinich Ahau, the Maya Sun God.

After the dirt and red dye were removed, we sat and stared at it for a long time, awed by its magnificence. The head weighs nine and three-quarter pounds, four pounds more than the largest Maya jade found previously at Tikal, Guatemala.

Once the furor subsided, we continued excavating this extremely rich tomb. With the badly decomposed and smashed skeleton were 149 other jade objects including long bead necklaces, pendants, bracelets, anklets and carved jade beads. Beyond this there were elaborately painted pottery vessels, various modified shells, bone needles, a beautifully carved bone pin, claws from several jaguar skins, groups of giant ceremonial flints, and a number of stuccoed objects, including bowls, probably wooden, of which only the shattered stucco coating remains.

The giant head is the showpiece of the tomb, but almost equally important are the many casts of rotted textiles and cordage which surrounded the body. These perishable objects, like many others in the tomb, had been totally destroyed by time and humidity. Cordage impressions have never before, as far as I know, been recovered in a Maya tomb. A number of negative textile impressions have been found at other sites, but these curious positive impressions, looking like the cloth itself, are apparently unique.

Discovery of this tomb, which we call the Sun God's Tomb, brings us closer to some aspects of Maya prehistory. At the same time it raises many unanswered, and perhaps unanswerable, questions. Why was the giant head—surely one of the finest jades from the Maya area—buried at Altun Ha, rather than at a major ceremonial centre? Does the presence of the Sun God's head indicate that other priests buried in this temple were also priests of this deity? If so, can we assume that the masks carved on the building's façade mark this as the temple of the Sun God? If this is in fact the Sun God's temple, the sacrifices atop the altars, which involved burning resin and destroying quantities of jade objects in the flames, are mystifying. How are these acts connected with worship of the Sun when jade was usually associated with Chac, the rain god, and other fertility gods? Is the position of the temple at the east side of a plaza significant? Was there some meaningful alignment of the altars with such events as mid-summer or equinoctial sunrises?

These, plus hundreds of other questions bearing on levels of ancient Maya life, confront us daily. With luck, we shall have dredged the answers to at least a few from the pits of antiquity by the time our work ends in 1969.

David M. Pendergast, author of *Temples and Tombs in British Honduras,* has been assisted at the site—located in a dense rain forest—by his wife, Esther. In addition to Altun Ha, Dr. Pendergast has excavated other areas of British Honduras, California, Utah and Mexico. Born in Oakland, California, in 1934, he completed his doctoral studies at the University of California, Los Angeles. In 1961 he became Assistant Professor of Anthropology at the University of Utah and in 1967 was appointed Associate Professor. With their cooperation, Dr. Pendergast received a six-month leave of absence each year since 1964 to be Field Director of the ROM's Altun Ha expedition. In July 1968, Dr. Pendergast joined the ROM staff full-time as Associate Curator, Office of the Chief Archaeologist.

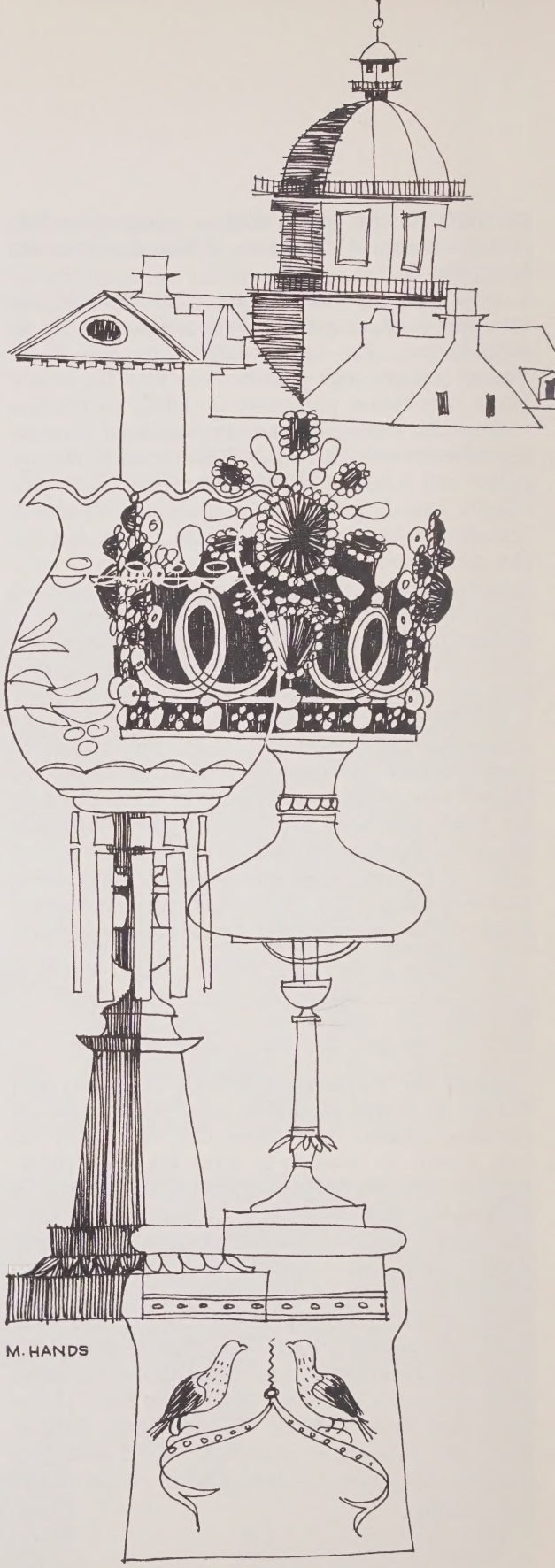
Recent publications

Three handsome books associated with the ROM appear in October. One is *Crown Jewels of Iran* by Drs. Meen and Tushingham who describe their work on the jewels in an article elsewhere in this issue. The 183-page, large format volume contains 83 colour plates vividly illustrating the splendour of the jewels. Published by the University of Toronto Press, the standard edition of this lavish book is $20. Also available, at $250 a copy, is a limited edition, hand-bound in leather, prepared to commemorate the coronation of the Shah of Iran.

Also published by the University of Toronto Press is *A Heritage of Light: Lamps and Lighting in Early Canadian Homes* by Dr. L. S. Russell, the Museum's Chief Biologist. Dr. Russell long has been interested in early forms of lighting and he owns a considerable collection of lamps. In his 352-page book he describes the 19th century revolution in artificial light from candles to electricity. He personally experimented with the different types of lamps and fuels used, from whale oil and grease to kerosene and natural gas. The merits and deficiencies of each fuel are considered and he includes such incidental information as how to make matches. Containing more than 200 illustrations, Dr. Russell's book, priced at $18.50, will appeal to collectors, to social historians, and to those interested in the technology of artificial illumination.

The third book is a facsimile edition of Coke Smyth's *Sketches in the Canadas*, originally published in 1840. It was prompted in part by Mary Allodi's article on Coke Smyth in *Rotunda* (Summer 1968). Published by Musson Anderson in cooperation with the ROM, this edition duplicates the paper and the cloth, gold-stamped cover of the original. The full colour lithographs are 21½ by 14¾ inches. Issued as a limited edition, the boxed volume retails at $75.

Also recently published is a book of particular interest to collectors of Canadiana. *The Brantford Pottery* by Donald B. Webster, Curator of the ROM's Canadiana Department, describes in detail pottery that was produced at Brantford, Ont., from 1849 to 1907. Containing numerous illustrations, the volume (ROM Art and Archaeology Occasional Paper No. 13) is available only through the ROM Sales Desk at $3.00.



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